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Residual Structural Capacity of Timber Components after Exposure to High Temperatures

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Experiments with heat exposure of wood samples with glued connections were performed and its residual capacity were tested, trying to find a nondestructive method of testing to determine the residual capacity after heat exposure and to see if the critical heat flux and the critical temperature were lowered due to the heat treatment. Two types of glued connections were used: 1) finger joined and 2) face bonding. The density and the ultrasonic speed parallel to the grain were recorded and for the finger joined connections the ultrasonic speed perpendicular to the grain at the finger joined were recorded. Four test series were made. One test series were to be used as reference elements. One test series were to be heated at 105°C and two test series were to be heated at 200°C. As the second 200°C series were heated and the sample for the 7th day were taken out of the heating cabinet, almost totally charred this test series was stopped. After the heating the ultrasonic speeds were recorded again together with the density while the samples still were hot. When the sampled had cooled down and stored for at least 7 days the color of the surface, density, ultrasonic speed, bending strength, modulus of elasticity, shear resistance, modulus of rigidity and the time to ignition under different heat fluxes were recorded by the use of a mass loss cone. The critical heat flux and the critical temperature were determined from these test results. The result shows no decreasing tendency for the ultrasonic speed, modulus of elasticity or the modulus of rigidity. There are shown a correlation between the residual strength and the time of heating, especially for the samples heated at 200°C. The major reason for this is that the heat transport along the glue line and into the glued connections, thereby causing a kind of delamination. A lowered critical heat flux and a lowered critical temperature were also found. It is suggested to look into the method of calculating the design procedures for mechanical resistance for the reduced cross-section method in the Eurocode 5 for glulam, by taking into account a computation parameter taking the effect of heat transported by the glue line into the wood, d_{glulam} .

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